

## Antimicrobial susceptibility of *Salmonella* isolated pig carriers

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**Summary:** Ninety-six *Salmonella* isolates from healthy carrier pigs were obtained from a survey in pig farms of Catalonia (Spain). Isolates were serotyped and examined for their antimicrobial susceptibility against a panel of 18 antimicrobial agents. Only isolates having different phenotypic and antimicrobial susceptibility characteristics were considered. With this restriction, we considered to have 62 different strains belonging to 17 serotypes. The most common serotype was Anatum (16.1 %) followed by Rissen (14.5 %), Typhimurium (11.3 %), Derby (9.7 %), Tilburg (8.1 %), Goldcoast (8.1 %) and Typhimurium variant 4,5,12:i:- (6.5 %). Others 10 serotypes were also isolated less than three times each. Antimicrobial susceptibility analysis showed that the highest level of resistance was against tetracycline (68.8 %). Sixty-two percent of the strains showed resistance to three or more antimicrobial agents and 46% were resistant to five or more drugs. The maximum number of compounds to which two strains were resistant was 10 (corresponding to a 4,5,12:i:- strain). None of the strains was resistant to colistin or ceftiraxone and 12 strains were susceptible to all antimicrobial agents tested

**Keywords:** S. Typhimurium, Multiresistance, Swine, colistin. Susceptibility

**Introduction:** Development of antimicrobial resistance is one of the most important health issues for public health authorities worldwide. It has been much debated about the possible role of animals as reservoirs of these resistances, especially for enteric pathogens such as *Salmonella*. In previous reports we showed that a high proportion of *Salmonella* isolates from pig faeces in Catalonia were multi-drug resistant (Mateu *et al.*, 2002). However, those studies were related to clinical cases and were not designed as a population survey. In the present report, we present the results of a survey conducted in finishing and sow units to determine the frequency of different *Salmonella* serotypes and the antimicrobial susceptibility profiles of the isolated strains.

**Material and methods:** One hundred and thirteen finishing units and 74 sow units of Catalonia (Spain) were bacteriologically examined to determine the prevalence of *Salmonella* serotypes. In each herd, twenty faecal samples were collected individually (sows) and twenty pooled fecal samples (5x5 gr faeces) were taken in finishing pens. All samples were inoculated in Rappaport-Vassiliadis broth and incubated at 42 °C performing subcultures at 37 °C onto XLT-4 agar at 24 h and 48 h. Suspect colonies were identified by means of biochemical tests and all strains classified as belonging to the *Salmonella* genus were sent to the National Reference Center for Salmonellosis (Algete, Spain) for serotyping. In parallel, isolates were examined for their antimicrobial susceptibility against a pannel of 18 antimicrobial agents (ampicillin, amoxycillin-clavulanic acid, ceftiofur, ceftiraxone, streptomycin, gentamycin, neomycin, apramycin, tetracycline, sulphonamides, sulphonamides+trimethoprim, cloramphenicol, nalidixic acid, flumequine, enrofloxacin, ciprofloxacin, colistin and nitrofurantoin) by means of the microdisk diffusion method of Kirby-Bauer. These determinations were done according the NCCLS standards.

**Results and discussion:** Ninety-six *Salmonella* isolates were identified out of 3667 examined samples. When several samples in a given farm yielded the same serotype, only isolates having different phenotypic and antimicrobial susceptibility characteristics were considered. With this restriction, we considered to have 62 different strains belonging to 17 serotypes. The most common serotype was

Anatum (16.1 %, 9 farms) followed by Rissen (14.5 %, 7 farms), Typhimurium (11.3 %, 7 farms), Derby (9.7 %, 3 farms), Tilburg (8.1 %, 2 farms), Goldcoast (8.1 %, 1 farm), Typhimurium variant 4,5,12:i:- (6.5 %, 4 farms). Serotypes Bovismorbificans, Bredeney, Diarizonae, Grumpensis, Infantis, Kapemba, Kedougou, Ohio, Seftenberg and Virchow were also isolated although less than three times each. Antimicrobial susceptibility analysis showed that the highest level of resistance was against tetracycline (68.8 %). Sulphonamides and their combination with trimethoprim were only active against 67.7 % and 53.1 % of the strains, respectively. Regarding  $\beta$ -lactams, 41.6 % of the strains were resistant to ampicillin and 18.7 % were resistant to the combination of amoxycillin and clavulanic acid. Finally, 17.7 % of strains were resistant to chloramphenicol. Sixty-two percent of the strains showed resistance to three or more antimicrobial agents and 46 % were resistant to five or more drugs. The maximum number of compounds to which one strain was resistant was 10 (corresponding to a 4,5,12:i:- strain. In addition 3 strains were resistant to eight or nine compounds. None of the strains was resistant to colistin or ceftriaxone and 12 strains were susceptible to all antimicrobial agents tested (serotypes Anatum, Goldcoast, Kapemba and Ohio). These results indicate that sub-clinical infection with *Salmonella* can be produced by multi-drug resistant strains. In addition, with very few exceptions, most of the detected serotypes were able to be resistant to more than three drugs. This fact suggests that antimicrobial resistance in *Salmonella* isolates from pigs is not an exclusive property of a given serotype, for instance Typhimurium, but a widespread characteristic. However, the wider spectrum of resistance is usually found in the 4,5,12:i:- variants of Typhimurium (De la Torre *et al.*, 2002). Taking together, these results show that antimicrobial resistance is a real problem in swine isolates of *Salmonella* and reinforce the notion that an improved knowledge of the impact of antimicrobial agents used in swine is required.

## References:

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## EFFECT OF CHLORTETRACYCLINE ON SALMONELLA AND THE FECAL FLORA OF SWINE

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**Summary:** The goals of this study were to determine the impact of sub-therapeutic chlortetracycline in market swine diets on 1) the prevalence and antimicrobial resistance of *Salmonella enterica* 2) antimicrobial resistance of the aerobic Gram negative fecal flora. There was no significant difference in the prevalence or antimicrobial resistance of *S. enterica* isolates. For the gram-negative fecal flora, there was a statistically significant difference ( $p < 0.05$ ) between treatment groups for the frequency of antimicrobial resistance in the gram negative flora with pigs receiving chlortetracycline having a greater frequency of isolates resistant tetracycline, gentamicin, and ceftriaxone, and a lesser proportion of isolates resistant to ampicillin.

**Introduction:** Antimicrobial resistance among human pathogens poses a serious burden to public health, resulting in \$0.15 to \$3 billion in health costs annually in the US (Rubkin, 1998). Increasing concerns over the contribution of antimicrobial use in agriculture to AR in human pathogens and